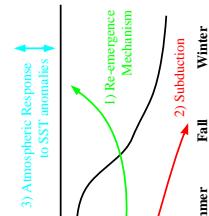


Air-Sea Interaction and Upper Ocean Processes in Midlatitudes

Introduction

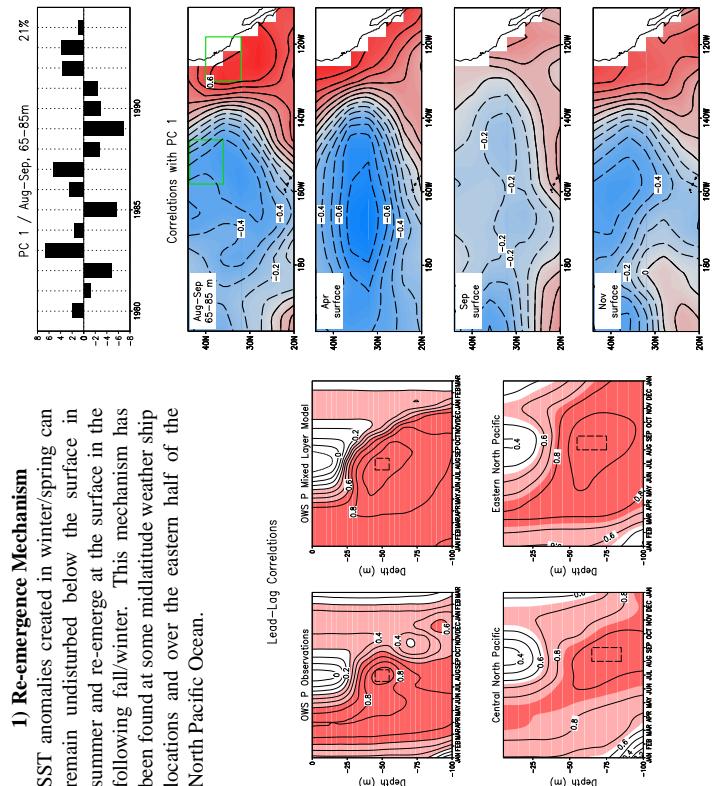
Midlatitude atmosphere-ocean interaction and interactions between the surface and deeper layers in the ocean may play an important role in seasonal to multi-decadal variability of the climate system. Here we examine three prominent midlatitude process: 1) the winter-winter re-emergence of midlatitude sea surface temperature (SST) anomalies; 2) the downward propagation (subduction) of temperature anomalies within the ocean and 3) the response of the atmosphere to midlatitude SST anomalies.



These processes are explored using subsurface data, mixed layer ocean model simulations, National Center for Environmental Prediction (NCEP) ocean data assimilation system, and atmospheric general circulation model experiments.

1) Re-emergence Mechanism

SST anomalies created in winter/spring can remain undisturbed below the surface in summer and re-emerge at the surface in the following fall/winter. This mechanism has been found at some midlatitude weather ship locations and over the eastern half of the North Pacific Ocean.



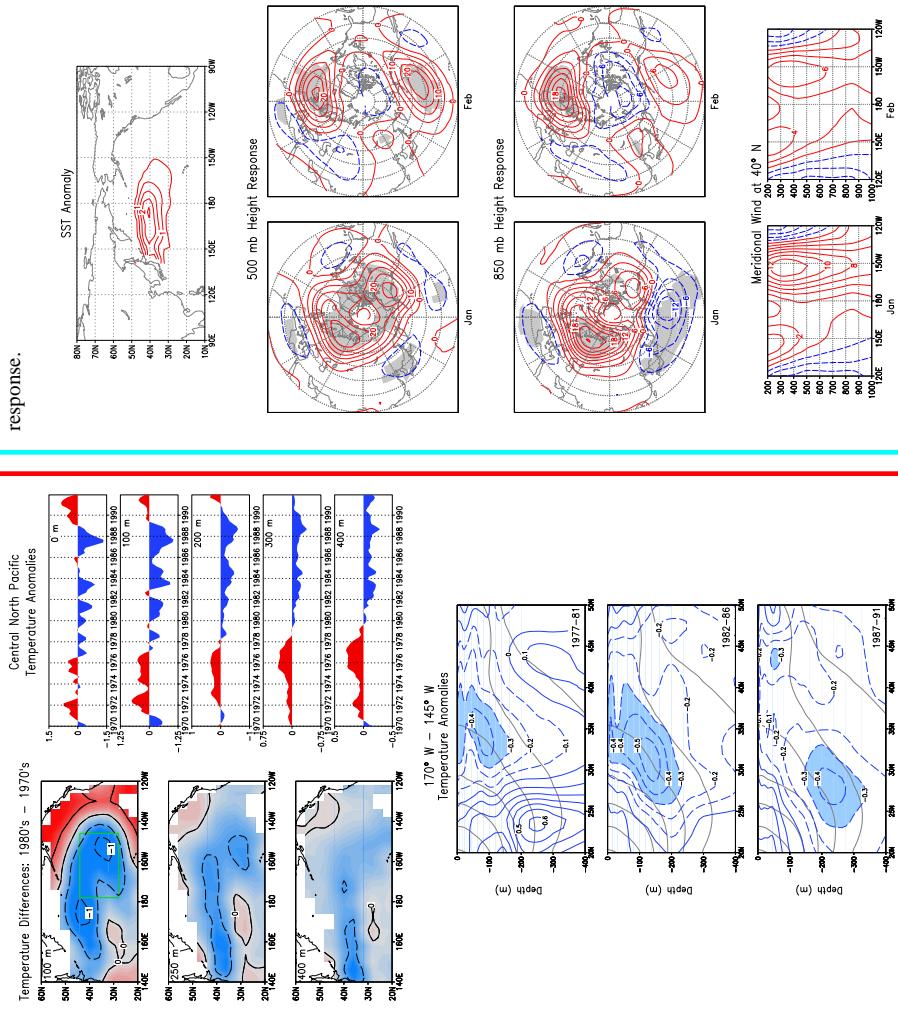
2) Subduction

Abnormally cold water first created at the surface in the central North Pacific during the mid 1970's, propagated down into the ocean, reaching depths of 400 m about 2 years later. Over a period of 15 years this cold water moved slowly down and southward with time following the general circulation of the North Pacific Ocean. The temperature anomalies appear to subduct from the mixed layer into the deeper ocean along isopycnal surfaces.

Methods

These processes are explored using subsurface data, mixed layer ocean model simulations, National Center for Environmental Prediction (NCEP) ocean data assimilation system, and atmospheric general circulation model experiments.

3) Atmospheric Response to SST Anomalies
In extended GCM experiments the same warm SST anomaly was used in two different model states: perpetual January and perpetual February. The atmospheric response to the SST anomaly while statistically significant in both differed greatly between the two. Temperature and vorticity budgets indicate that the intensity of the mean meridional wind downstream of the SST anomaly may have played a critical role in shaping the atmospheric response.



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